

PATENT SPECIFICATION



Application Date: June 23, 1925. No. 29,491 / 24.

249,184

Complete Accepted: March 25, 1926.

COMPLETE SPECIFICATION.

Improvements in Steam Condensing Plant.

We, HARRY GIBBS and THOMAS HENRY GIBBS, both of 21, Apple Grove, Higher Tramere, Birkenhead, English, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has for its object the improvement of steam condensing plant, in such a manner that the usual weight and costs and size of this type of plant is greatly reduced, and more particularly when atmospheric air is to be the cooling medium, for land engines and road and rail steam locomotives for the purpose of condensing exhaust steam and creating vacuum to increase engine power when operated in conjunction with any ordinary reciprocating or other type of air pump. This object is attained as hereunder described.

In previous forms of the plate type apparatus, instead of the usual tubes, flat, thin or corrugated metal plates are provided for the condensing surfaces. A pair of such plates are placed together and their peripheries sealed by any suitable method, and a passage being maintained between them by indents on one or both plates, or wire gauze between, or corrugations in the said plates. This constitutes an element. A number of such elements are connected together with all inlet orifices jointed together on a common axis, and all outlet orifices also co-axial, have been described. The present invention relates to detail improvements to the above type of apparatus and is not intended for internal pressure in its elements, it is of, therefore, very light construction and weight; the danger of internal pressure being eliminated by a lightly loaded relief valve in the exhaust pipe before the steam reaches the condenser. External

pressure, as when vacuum exists within, is balanced by both plates being of equal area, and a passage is maintained by the said plates being corrugated. Each plate is exactly alike and pressed from the same die, with the corrugations at a slight angle to the vertical, the edges are left plain for sealing purposes. To form an element, two corrugated plates, as described above, are placed together with one plate reversed in such a manner that the corrugations cross at an angle of about 20 degrees to each other, the peripheries are then welded or brazed, the inlet and outlet orifices having previously been prepared.

The corrugations being crossed in the manner above described, serve the double purpose of maintaining passages between the plates when subjected to vacuum within, or external pressure, and also provides against the ill effects of unequal expansion, as, for instance, when the outer casing and elements are composed of dissimilar metals; and also the unequal expansion in a horizontal direction due to the steam and cooling agent flowing in opposite directions vertically, the corrugations acting after the manner of expansion bends in a pipe line. In this invention, a suitable back plate is provided, preferably a casting, with exhaust steam flange connections and large ports to connect up to inlet and outlet orifices of elements, the inlet ports are of much larger area than the exhaust pipe area, for the purpose of providing ample entrance to the condensing surfaces, such as is required in modern condensers.

For a water cooled condenser, the back plate would preferably provide:—A foundation for the whole apparatus, provision for exhaust connection, ports of large area and means of attaching elements thereto, connection for air pump and means for connecting outlet orifices

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of elements to same, screwed studs for securing cover casting in position, and a branch and flange top and bottom for the admission and discharge of cooling water; for air cooling a much larger admission and discharge arrangement is provided; the back plate is further provided with two or more rubber covered brackets for the double purpose of supporting and registering the elements when erecting after repair or inspection, without laying the back plate flat, and, effecting a seal to ensure the cooling water all passing between the elements and not through the clearance spaces between the cover and elements. The cover is provided with a rubber pad or strip for the same purpose as described above.

To erect a complete condenser, a back plate as before described is provided, and suitable rubber joints attached around inlet and outlet ports, these joints to be composed of rubber with ridges moulded on one side only, to suit and fit corrugations in first element; next an element is placed in position, which position is decided by the previously described rubber covered registering brackets; the next operation is to attach another rubber joint to each orifice; but these joints differ from the previous ones by having ridges moulded on each side, the ridges crossing at a similar angle to the crossed corrugations between elements and fitting same.

Every alternate plate in a condenser has its corrugations sloping in one direction and the intervening plate corrugations are sloped in the opposite direction; therefore, no further separating arrangements are necessary between elements, the reverse side of the corrugations providing the passage for the cooling medium.

The fifth operation when erecting is to place the second element in position, and the third joint; this operation is repeated till the required number of elements are in position, and the last joint will be similar to the first, viz:—Ridged on one side only: over the last joint, a blank flange is placed through which a long clamping bolt is passed, through all inlet and outlet orifices and attached to the back plate, and when tightened by means of a nut, the whole makes a vacuum tight joint.

The extraction orifices in the present invention are made with particular attention to their draining properties, and are made on the extreme bottom edge of the elements with a portion of their internal circumference forming the lowest part of the internal part of the elements:

Reference to the accompanying drawings will show the manner in which this invention is carried out.

Figure 1 is a front sectional elevation through drain and air cock facings 37 & 38. 70

Figure 2 side sectional elevation through centre.

Figure 3 elevation of back of base reversed to show facings for pipe connections. 75

Figure 4 elevation of an element, opened to show crossed corrugations.

Figure 5 elevation and section of moulded crossed ribbed rubber joint for exhaust steam inlet ports. 80

Figure 6 elevation and section of ribbed rubber joint for extraction orifices, or inlet ports if these are desired to be of circular shape. 85

10 and 11 clamping nuts, which in combination with studs 18 and 19 and blanking plates 20 and 21, secure any number of elements to back plate 16.

12 flange for connecting exterior exhaust pipe to port 27, and inlet ports 27^a to elements. 90

13 facing for extraction pipe to air pump.

14 facing for cooling water inlet pipe. 95

15 facing for cooling water discharge pipe.

35 alternative larger provision for air cooling inlet.

36 large discharge connection for air cooling. 100

22 and 23 moulded and ribbed rubber joints between exterior sides of elements with ribs crossed to suit corrugations.

24 cover plate designed for easy access, here shown as a casting with facings 37 and 38 for drain and air vent cocks. 105

25 and 26 inlet and discharge orifices for cooling water.

28 extraction orifices. 110

29 brackets, provided with rubber pads 30 for supporting and registering the elements when assembling, and also sealing up the clearance spaces.

31 a further supporting bracket provided with rubber pad 32. 115

33 a projection formed across cover 24 carrying rubber pad 34 to make contact with plate 20 for the purpose of preventing water passing wastefully through the clearance space between cover and elements. 120

39 and 40 also 41 and 42 showing ridges on rubber joints, slanting to the left on one side, and the right on the other side. 125

43 one plate of an element with its corrugations 45 slanting to the left and 44 second plate of the same element, torn open, and showing its corrugations slanting to the right. 130

- 47 arrows showing direction of steam flow.
 48 arrows showing direction of flow for cooling water.
- 5 Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—
- 10 1. Improvements in the plate type of steam condensing apparatus in which plates with crossing corrugations are employed for the purpose of maintaining passages within and without each element
- 15 for the flow in opposite directions vertically of the cooled and cooling fluids: in which the said corrugations are arranged at about 10 degrees from the vertical in each plate in opposite directions, viz.:—
- 20 Inclusive angle about 20 degrees, for the purpose of acting as expansion bends, to obviate the ill effects of continually varying local temperatures and unequal expansions in horizontal direction
- 25 between casing and elements and different parts of each element.
2. Condensing apparatus as claimed in Claim 1 having a large area of inlet port as compared with exhaust pipe area, as
- 30 shown by drawings herewith.
3. In condensing apparatus as claimed

in any of the foregoing claims the elimination of all water pockets on the inner side of elements by shaping the lower edge of elements in such a manner that all condensed water drains rapidly to the bottom of the extraction pipe.

4. In condensing apparatus as claimed in any of the foregoing claims the use of rubber joints, with ridges moulded on each side, the said ridges are inclined on each side to suit and fit the exterior corrugations between two adjacent elements, and moulded joints to suit both inlet and outlet orifices substantially as described.

5. In condensing apparatus as claimed in any of the foregoing claims the use of rubber pads carried on brackets attached to the base plate for the purpose of registering and supporting the elements when erecting, and sealing the clearance spaces to ensure all water passing between elements, cover plate is provided with rubber pad for same purpose substantially as described.

6. The improved apparatus substantially as hereinbefore described and illustrated in the accompanying drawings.

Dated this 9th day of February, 1926.

H. GIBBS.

T. H. GIBBS.

[This Drawing is a reproduction of the Original on a reduced scale.]

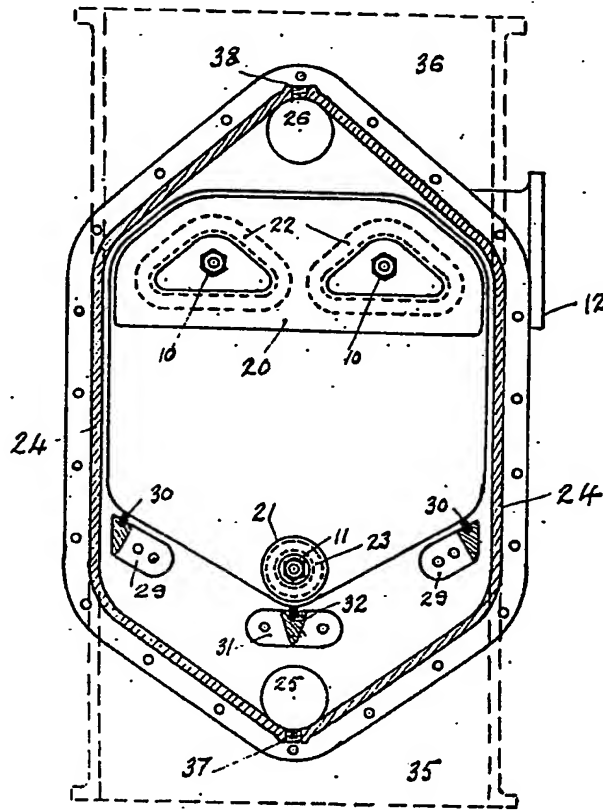


Fig. 1.

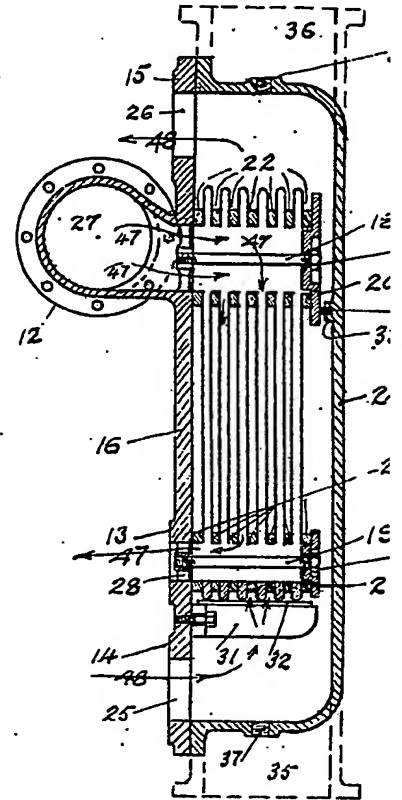


Fig. 2.

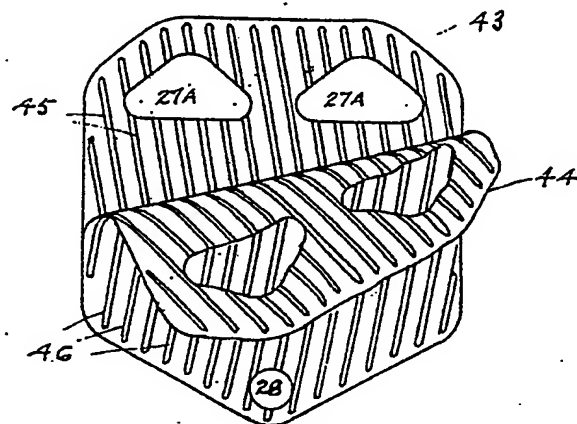


Fig. 4.

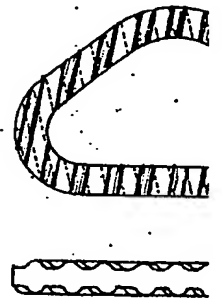


Fig. 5.

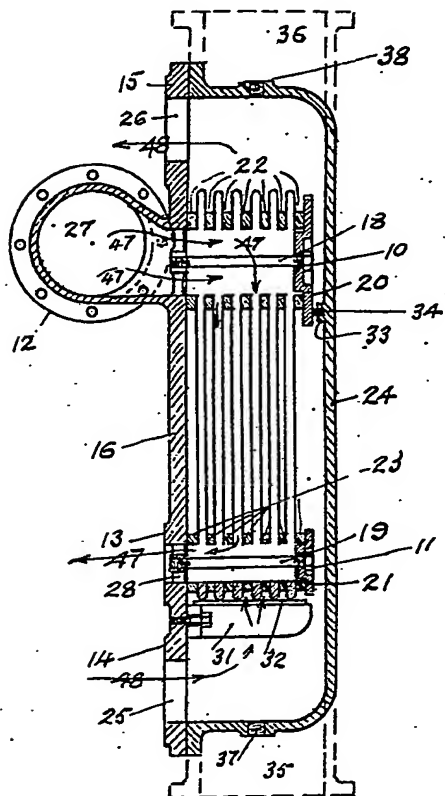


FIG. 2.

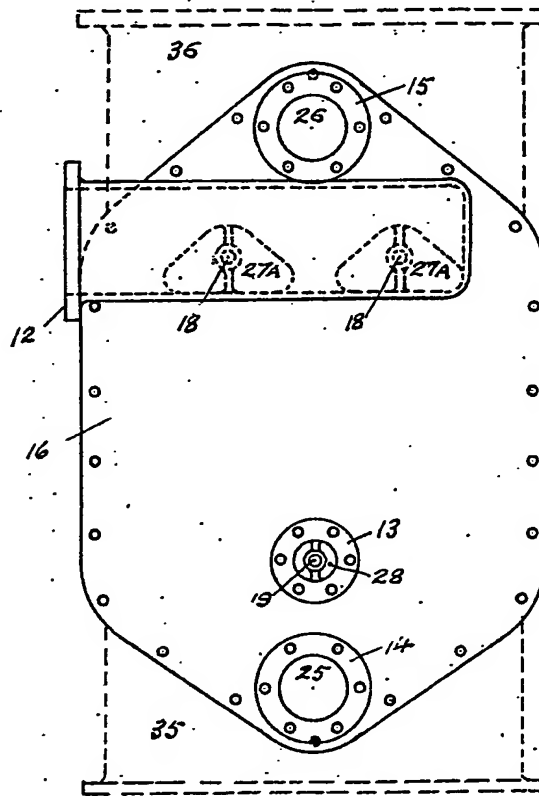


FIG. 3.

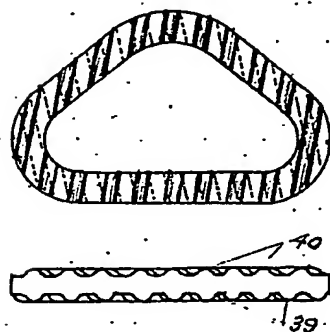


FIG. 5.

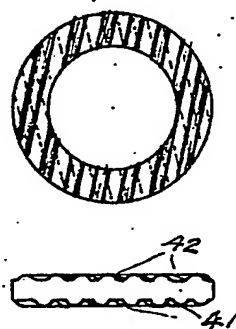


FIG. 6.

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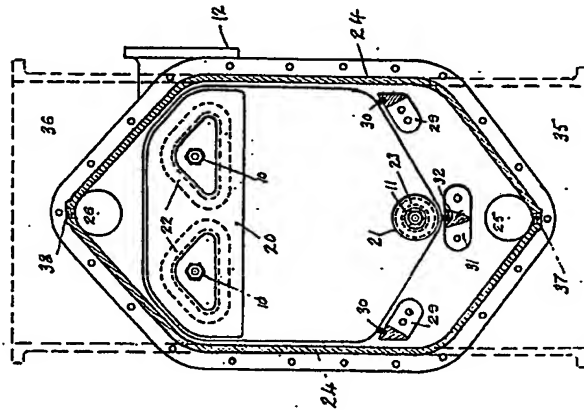


Fig. 1.

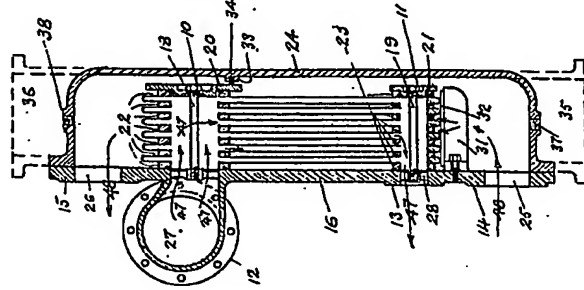


Fig. 2.

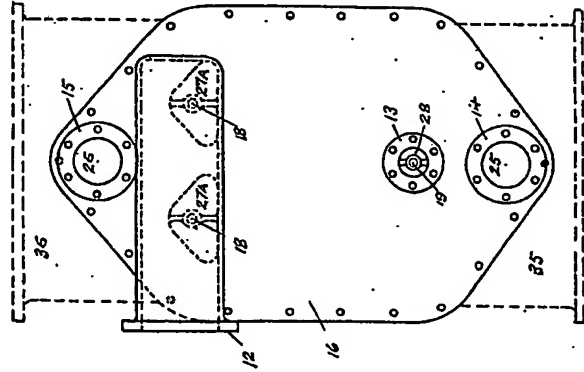


Fig. 3.

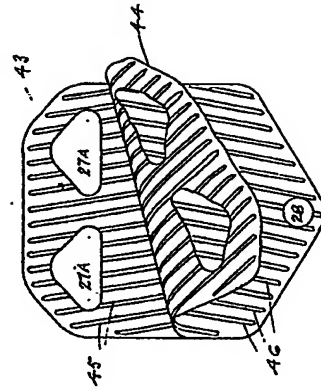


Fig. 4.

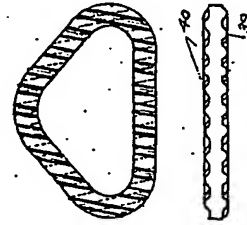


Fig. 5.

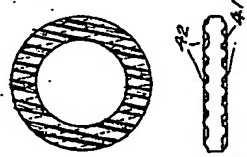


Fig. 6.

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